

REMARKS

Applicants respectfully request entry of this Preliminary Amendment prior to the first Official Action and prior to calculating the fees for the application.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to deposit account No. 23-1123.

Respectfully submitted,

WESTMAN, CHAMPLIN & KELLY, P.A.

By: 

Steven M. Koehler, Reg.No. 36,188  
Suite 1600 - International Centre  
900 Second Avenue South  
Minneapolis, Minnesota 55402-3319  
Phone:(612) 334-3222 Fax:(612) 334-3312

JRK:slg

**MARKED-UP VERSION OF REPLACEMENT PARAGRAPHS**

The present invention deals with mobility assistance. More particularly, the present invention deals with a vision assist device in the form of a head up display (HUD) for assisting mobility of a mobile body, such as a person, non-motorized vehicle or motor vehicle.

FIG. 2 also illustrates that system 10 can include optional vehicle orientation detection system 31 and optional head tracking system 32. Vehicle orientation detection system 31 detects the orientation (such as roll and pitch) of the vehicle in which system 10 is implemented. The roll angle refers to the rotational orientation of the vehicle about its longitudinal axis (which is parallel to its direction of travel). The roll angle can change, for example, if the vehicle is driving over a banked road, or on uneven terrain. The pitch angle is the angle that the vehicle makes in a vertical plane along the longitudinal direction. The pitch angle becomes significant if the vehicle is climbing up or descending down a hill. Taking into account the pitch and roll angles can make the projected image more accurate, and more closely conform to the actual image seen by the driver.

Of course, other objects can be displayed as well. Such objects can include water towers, trees, bridges, road dividers, other landmarks, etc... Such indicators can also be warnings, local speed limits or alarms such as not to turn the wrong way on a one-way road or an off ramp, that the vehicle is approaching an intersection or work zone at too high a high rate of speed. Further, where the combiner is equipped with an LCD film or embedded layer, it can perform other tasks as well. Such tasks can include the display of blocking templates which block out or reduce glare from the sun or headlights from other cars. The location of the sun can be computed from the time, and its position relative to

the driver can also be computed (the same is true for cars). Therefore, an icon can simply be displayed to block the undesired glare. Similarly, the displays can be integrated with other operator perceptible features, such as a haptic feedback, sound, seat or steering wheel vibration, etc.

The coordinate transformation block transforms the coordinate frame of the digital map from the global coordinate frame to the local coordinate frame. The local coordinate frame is a moving coordinate frame that is illustratively attached to the driver's head. The coordinate transformation is illustratively performed by multiplying a four-by-four homogeneous transformation matrix to the road data points although any other coordinate system transformations can be used, such as the Quaternion or other approach. Because the vehicle is kept moving, the matrix must be updated in real time. Movement of the driver's eye that is included in the matrix is also measured and fed into the matrix calculation in real time. Where no head tracking system 32 is provided, then the head angle and position of the driver's eyes are assumed to be constant and the driver is assumed ~~to be~~ to be looking forward from a nominal position.

$${}^L p = {}^L_G [T_{rot}] {}^G P \quad \text{Eq. 6}$$

$${}^L p = {}^L_G [T] {}^G P \quad \text{Eq. 8}$$

$${}^L_G [T] = {}^L_G [T_{rot}] {}^L_G [T_{tran}]$$

$${}^L p = {}^L_V [T] {}^V_G [T] {}^G P = [T] {}^G P \quad \text{Eq. 10}$$

$$p_x = p_{ix} + k \Delta p_x \quad \text{Eq. 39}$$

**MARKED-UP VERSION OF REPLACEMENT CLAIMS**

16. (Amended) The display of claim 1 wherein the conformal, augmented display, comprises:

displayed ~~target~~sensed objects, displayed at a perspective approximately equal to a perspective that would be perceived from an operator position at a location of the mobile body by an operator who has visual contact with actual ~~targets~~objects corresponding to the displayed ~~target~~sensed objects.

17. (Amended) The display of claim 16 wherein the displayed ~~target~~sensed objects are positioned within a field of view of the operator in the operator position, at a location which approximately overlies the actual ~~target~~sensed objects in the field of view.

18. (Amended) The display of claim 17 wherein the displayed ~~target~~elementsensed objects are displayed in a forward-looking view of the operator.

19. (Amended) The display of claim 18 wherein the mobile body comprises a vehicle and wherein the vehicle travels over a roadway and wherein the displayed ~~target~~elementsensed objects correspond to transitory ~~targets~~objects, not fixed in place during normal operating circumstances of the roadway.

20. (Amended) The display of claim 19 wherein the transitory ~~targets~~objects comprise:

other vehicles proximate to the roadway.

21. (Amended) The display of claim 19 wherein the transitory ~~targets~~objects comprise:

pedestrians or animals proximate to the roadway.

Add New Claims

48. (New) The mobility assist device of claim 25 wherein the display system is mounted to the mobile body.

49. (New) The display of claim 1 and further comprising:  
a warning display, warning of a local speed limit which the  
mobile body is approaching.